

MICROWAVE SYSTEM, GENERAL

8042

(No. 9 Sept. 1995)

CDF is, in a sense, a shareholder in the state-owned microwave system. Funds from our telecommunications budget, combined with funds from other user agencies, go to the Telecommunications Division to support their management of the system. Division staff design components for the system, install and maintain equipment, and monitor system performance.

The microwave system was developed in the late 1950s to provide an emergency backup to commercial telephone service. It is sometimes referred to as the Statewide Public Safety Telephone System, or "Green phone system." Its primary purpose is to ensure critical public safety communications in the event regular telephone service is knocked out by fire, flood, earthquake, acts of war or other disasters.

Microwave refers to radio frequencies in the higher portion of the radio spectrum, typically those above 1000 MHz, where wavelengths are micro, or small. In public safety applications the frequencies usually range from 960 MHz to 23,000 MHz.

Microwave transmitters and receivers are normally enclosed in standing cabinets that are securely installed inside radio vaults. Their antennas are horn or dish shaped. Due to high signal loss at these frequencies, wave-guides (large, highly efficient cables) are used to transmit signals up and down their supporting towers. Microwaves are transmitted in narrow beams, similar to light from flashlights or lasers. This requires that antenna towers be quite sturdy and free of wind-sway, to keep the microwave "beam" on its correct path from antenna to antenna. Like all radio transmissions, microwaves are vulnerable to interference from mountains, buildings, trees and other structures which can block the signal-path. This is the reason microwave towers are constructed on mountain tops, building roofs and in flat, open country.

MICROWAVE SYSTEM PRIMARY FUNCTIONS

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CDF uses the state microwave system for the following purposes:

Green Phone Communications

The public safety telephone system connects units, region and area offices, Sacramento HQ, the CDF Academy, some airtanker bases, and various cooperating agencies, including OES and state military headquarters.

Dialing instructions are found in the CDF Telephone and Facility Directory.

Command Center Intercom Systems

There are two intercom systems, party-line type, which connect all CDF dispatch centers and are used to coordinate local, regional and statewide movement of resources. The Sacramento intercom connects the Sacramento Command Center with region CCs/ USFS North and South Zone dispatch centers, and other cooperating public safety agencies. The region intercoms connect the region CCs with unit ECCs and cooperating agency dispatch centers. Some airtanker bases are also linked to the region intercoms.

Sacramento Command Center and the two region CCs have the capability of monitoring and interconnecting the region intercoms.

Remote Base Station Control

Enables control of remote mountaintop base stations (Airguard, for example) and mobile relays where control by VHF radio signals is not possible

Inter-Tie Capabilities

The microwave system may be used to inter-tie some of its own components and some OES mobile relays. In the latter case, the OES mobile relay system can be effectively extended by selecting and connecting relays to the microwave "backbone."

Example: St. Helena ECC transmits the connect code to the OES Mt. St. Helena mobile relay which then connects the relay to the North Coast microwave backbone. St. Helena transmits the Red Mountain connect code to Mt. St. Helena--this connects the Red Mountain relay to the backbone. St. Helena ECC can now talk to OES apparatus in Del Norte county.

At the end of the communications, St. Helena transmits the Red Mountain disconnect code followed by the Mt. St. Helena disconnect code. This restores the system to normal operation (See OES Fire Communication Manual for detail and codes).

MICROWAVE SYSTEM COMPONENTS

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Audio Facilities

Audio facilities consist of the telephone equipment associated with the green phone system, the consoles associated with the intercoms and remote VHF base stations, and the circuitry connecting these units to the multiplex subsystem.

Multiplex Subsystem

This equipment is rack-mounted in circuit card cages in the radio vaults and consists of channel modems, amplifiers, channel oscillators, etc. The purpose of multiplex equipment is to insert or remove the audio information on the assigned channel of the microwave carrier (backbone). Multiplex equipment is required for each channel at each end of the microwave route.

RF Subsystem

This equipment is enclosed in a cabinet and rack mounted in the radio vaults and consists of the microwave transceivers, transmission lines and antennas. Provides the RF carrier (backbone) for the total microwave system. A transceiver, transmission line and antenna is required at each end of a microwave path.

Antenna

Due to the line of sight and low power characteristics of microwave transmission, the antenna is dish-shaped which increases the effective power and shapes the radiated signal into a narrow beam. Antenna orientation and tower rigidity are critical to reliable communications.

Piece Out

A telephone line designed to handle audio signals without distortion and with minimum power loss, when associated with the microwave system, is known as a piece-out. These circuits are used to extend microwave service sites that are too far from the multiplex equipment for direct connection.

Routes

The microwave RF subsystem has been divided into eight major routes, each isolated from the other. The names and general routing are as follows:

North Coast - Sacramento to Redding via coast range.

North Valley - Sacramento to Redding and north via east side of the Sacramento Valley.

Truckee-Lassen - Sacramento to Redding via east Sierra Nevada.

South Coast - Sacramento to Los Angeles via coast range.

South Valley - Sacramento to Los Angeles via east San Joaquin Valley.

East Sierra - Sacramento to Los Angeles via east Sierra Nevada.

Southern California - Los Angeles to Blythe and Los Angeles to El Centro.

Los Angeles Local - Covers greater metropolitan Los Angeles.

Backbone

The microwave backbone is functionally created by the interconnection of individual path sections to join the two extreme ends of a microwave route together. A secondary backbone is created by the interconnection of several paths to reach a point divergent from the main backbone. Generally, a backbone has one or more short branches (stubs) at intermediate points for local service.

Stubs

Stubs are those branch microwave sections from the backbone occurring at intermediate points to provide a local service drop. Generally, no more than three microwave paths interconnected end-to-end may be considered a stub.

Route Switch

The route switch provides for automatic rerouting of certain high priority circuits that extend between the Redding, Sacramento, and Los Angeles microwave centers.

The route switching circuitry selects the best route (North Coast, North Valley, or Truckee-Lassen) between Sacramento and Redding--and the best route (South Coast, South Valley, or East Sierra) between Sacramento and Los Angeles.

Drawing an analogy to a freeway system, the RF subsystem would be the main traffic lanes, the multiplex subsystem would equate with on/off ramps, and the route switching centers would be the major freeway interchanges.

MICROWAVE SYSTEM MAINTENANCE

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The Telecommunications Division is responsible for microwave (m/w) system maintenance. As is true with VHF radios, the TCO should gather all information possible before reporting trouble to the radio shop. This will assist the technicians in swiftly identifying and isolating the problem.

Outages in m/w systems are more frequently caused by atmospheric conditions than by equipment failures. Precipitation may absorb or deflect the transmitted m/w energy, causing "precipitation noise." An inversion layer may cause m/w path bending by refracting the transmitted beam so it goes off-target at the receiving antenna. Trees on CDF property may need to be trimmed periodically due to blockage of the microwave paths.

Report m/w problems to the local radio maintenance shop, or the area supervisor if technicians are unavailable. Outages affecting ECC operations, particularly during periods of high fire activity, must be dealt with as soon as possible. The TCO should not hesitate to be assertive in describing an urgent need for repair service. Repetitive problems must be documented by TCOs and forwarded through channels to the Senior TCO at Sacramento HQs. for resolution with the Telecommunications Division.

MICROWAVE SYSTEM INSTALLATION AND MODIFICATION

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Installation and modification of microwave systems is largely the concern of the Telecommunications Division. The CDF field TCO seldom becomes involved, but there are certain minor modifications which may be needed--for example, adding or moving a green phone circuit or extending an intercom circuit to an airtanker base or cooperating agency. Form COM-207, Telecommunications Work Authorization, is prepared and routed in the same manner as for other radio work. See Section 8060 for COM-207 details [{see section 8060}](#).

FORMS AND/OR FORMS SAMPLES: RETURN TO ISSUANCE HOME PAGE FOR FORMS/FORMS SAMPLES SITE LINK.

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